

Assessing the State of Financial Distress in Listed Companies in Ghana: Signs, Sources, Detection and Elimination – A Test of Altman's Z-Score

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Abstract

This article discusses the corporate financial distress in the light of its meaning, signs, sources, detection and methods of elimination. The article applies Altman's Z-Score to the financial statements of ten companies listed on the Ghana Stock Exchange (GSE) to determine the level of their financial soundness. The data used in the study were drawn from the website of ARG covering the period 2007 to 2013. The study finds six companies being financially sound and not in danger of financial distress, two companies in financial distress and two others in state of deterioration and likely candidates for financial distress. It is however worth noting that the two companies found to be in financial distress have not filed for bankruptcy in the period of the study.

Keywords: Altman's Z-Score, Bankruptcy, Financial Distress, listed companies

1. Introduction

The increase in the growth of privately-financed infrastructural projects, more than the publicly-financed projects, is due to the emerging concepts of privatization and globalization (Ray et al., 2008). Risk management is a very important concept for any business as most financial decisions revolve around the corporate cost of holding risk (Amidu and Hinson, 2006). It is of particular relevance to banking institutions and governments in governments in collaborating in the construction of projects in a public-private partnership projects. The ability to predict company failure is particularly important from both the private investor's viewpoint and the social viewpoint, as it is an obvious indication of resource misallocation (Glautier and Underdown, 2001). Although corporate ethics and governance have created a platform to prevent financial distress, the early prediction of distress is essential for investors or lending institutions who intend to protect their financial investments (Muller et al., 2009).

Recent history indicates that there have been several corporate failures throughout out the world. During these last years, the annual flow of failures of companies did not stop growing and this trend becomes more marked during the periods of crisis (Sami, 2013). Particular mention can be made of Enron Corp, WorldCom, Xerox, Lehman Brothers, AIG, and Freddie. In Ghana, recent cases of corporate failures include the Gateway Broadcasting Services, Ghana Co-operative Bank, Bank for Housing and Construction, National Savings and Credit Bank (Appiah, 2011). A case of corporate failure that is still fresh on the minds of Ghanaians is the acquisition of Merchant Bank Ghana Ltd. by Fortiz Private Equity Fund Ltd. Among the reasons cited for the sale of Merchant Bank was solvency and liquidity challenges faced by the bank (Bank of Ghana, 2013).

Many studies in finance support the need for prediction of the financial soundness and the likely occurrence of financial distress in project and companies. Glautier and Underdown (2001) point out that an early warning signal of probable failure would enable both management and investors to take preventive measures. The warning signs and Z score model have the ability to assist management for predicting corporate problems early enough to avoid financial difficulties (Ray, 2011). Predicting failure as early as possible with sound accuracy enable firms to take action to reduce the costs of bankruptcy, avoid failure to all stakeholders and contribute towards the business and financial environment stability (Gharaibeh et al., 2013). According to Vuran (2009), the development and use of models can be very important in two different ways. First, as "early warning systems" such models are very useful to managers, authorities... etc. Second, such models can be useful in aiding decision making of financial institutions in firms' evaluation and selection.

This article is quite timely in addressing the needs of companies in the Ghanaian economy. Like most economies in the world, the Ghanaian economy has undergone significant down turn in 2014 with high interest rates, inflation rising from single digit to 16.9% in October, 2014, foreign exchange rates reaching a record high, and utility prices almost doubling. This has the potentiality of putting corporate entities into a financial distress. An early warning signal from this study would lead to corrective measures taken to forestall the problems associated with financial distress. This study has the object of determining the signs, sources, and elimination of financial distress in projects and companies in Ghana. It is also meant to test the business environment for the effective implementation of private finance initiatives in Ghana.

The paper adds to the existing literature on finance and more especially on the detection of corporate

financial distress in developing countries, particularly Ghana. Recent studies on this area include those conducted by Appiah (2011) and Amoa-Gyarteng (2014). Appiah's study was on corporate failure prediction on some listed firms in Ghana using data from 2004 and 2005 while Amoa-Gyarteng did an empirical investigation on AngloGold Ashanti, a listed company in the mining sector. My study is unique in model application, the number of companies covered, data selection, and period coverage. Results of the study would help the major stakeholders in private finance initiatives – Government of Ghana (represented by the treasury and government agency) and funders (financial institutions) – in selecting private sector companies for collaboration in setting up project companies (special purpose vehicles). Probable area of collaboration between Government of Ghana and private sector players could be in the new found and infant oil and gas industry which requires substantial investment.

The remaining part of the paper presented as follows: the first section discusses methodology and data, the second deals with the literature review, the third section discusses the detection model, the fourth section discusses the results, the fifth section is the conclusion, the sixth section is the reference list and the final section presents the tables of computation of Z-Score.

2. Methodology and Data

The study data were extracted from the financial statements (statement of comprehensive income and the statement of financial position) of companies listed on the Ghana Stock Exchange. Data for the study were taken from the website of Annual Reports Ghana (ARG). I applied Altman's Z-score model to the financial data of ten selected companies out of the thirty-eight listed on the GSE. The companies studied are African Champions Industries Ltd., Aluworks Ltd., Ayrton Drugs Manufacturing Company Ltd., Benso Oil Palm Plantations Ltd., Fan Milk Ltd., Ghana Oil Company Ltd., Produce Buying Company Ltd., PZ Cussons Ghana Ltd., Total Petroleum Ghana Ltd., and Unilever Ghana Ltd. The companies were selected on the basis of their industry of operation and the availability of up-to-date data on the website of ARG. To this end, seven out of the companies studied operate in the manufacturing sector, two in the petroleum distribution and marketing sector, and one in distribution of cocoa beans. The list also includes a company in which the Ghana Government has a significant shareholding, a quasi project finance company. This helps in ascertaining the performance of project financed companies in the Ghanaian business environment.

The period covered by the study spans from 2007 to 2013, a period long enough to detect any financial distress through the application of the Z-Score. The selection of the period of study also takes into consideration the accounting principles adopted in the presentation of the financial statements in Ghana. Ghana has since 2007 adopted International Financial Reporting Standards (IFRS). Prior to this, financial statements were presented on the basis of Ghana National Accounting Standards developed by the Ghana National Accounting Standards Board (GNASB). The inclusion of periods prior to the adoption of IFRS could have a significant effect on the values of the financial metrics used and the results of the study.

3. Literature Review

3.1 Meaning and Signs of Financial Distress

While agreeing that several names are attributed to the financial ill-health of a company, specific meanings have been given a specifically described ill-health. Names that have been used in descriptions include corporate/business failure, insolvency, illiquidity, and bankruptcy. Financially distressed firms are firms that are experiencing financial difficulties in maintaining their normal operations and in most severe conditions are potential candidates to the bankruptcy proceedings (Baharin and Sentosa, 2013). Adeyemi (2011) defines distress situation to mean having operational, managerial and financial difficulties. Business failure is the situation that a firm cannot pay lenders, suppliers, shareholders, etc., or a bill is overdrawn or the firm is bankrupt according to the law (Vuran, 2009).

Researchers in this on corporate distress have identified varying signs of distress. Companies that consistently generate lower realized rate of return compared to the market rate for similar investments, having average return that is lower than the cost of capital or do not have enough revenue to meet their cost can be classified as experiencing business failures (Baharin and Sentosa, 2013). Amoa-Gyarteng (2014) argues that highly leveraged firms may face bankruptcy if they are unable to meet repayment schedules, though it may also increase shareholder Return on Investments. Usdin and Bloom (2012) have identified nine signs of financial distress as: the company not timely paying creditors; the company being sued in collection matters; the company suffering a significant event that will not recur; the company's bank or secured lender threatening to shut down business operations; a union threatening some type of action against the company; a major supplier threatening to terminate services to the company; the company no being able to perform its contracts on time or cannot perform at all; the liabilities of the company being greater than its assets; and the company's business model no longer being viable.

Sami (2013) indicates that the financial distress is bound to cash flow problems and of incapacity of

refund of the debts. He points out that a firm in distress meets three difficulties: it loses the right to make certain decisions without legal approval; the financial distress can reduce the demand for the product of the firm and increase the production costs; and the managers lose considerable time to solve the financial distress. However, Zhuang and Chen (2014) indicate that the financial state of a company often cannot be observed directly, but only some signal indicators associated with the financial state can be observed. In their study, they established a discriminant model which is used to describe the correlation between the financial state and the signal indicators.

3.2 Dealing with Financial Distress Problems

In a move to resolve problems of distress, Usdin and Bloom (2012) have suggested the use of professionals who are independent of the pressures inherent in managing a company (including internal, emotional or family pressures) and are available to analyze and advise a company in a difficult financial position. Such professionals include Turnaround specialists, Attorneys specializing in advising distressed companies, and Accountants specializing in assisting distressed companies. Collard (2010) emphasize the relevance of a Turnaround specialist in turning the fortunes of a distressed company around indicating that the specialist must conduct fact-finding to assess the situation and then prepare a plan to fix the problems. He came out with a five stage turnaround process: management change, situation analysis, emergency action, business restructuring, and return to normal. Bhunia et al. (2011) argue that a spontaneous protective effort could be accommodated if the company is anticipated to be proceeding in the direction of potential bankruptcy and this can help alleviate the financial distress to all investors and decrease the costs of bankruptcy. They however pointed out that resolving corporate distress may result in conflict of interest between shareholders (who would want the company to invest risky but high return projects so that firm value would rise) and creditors (who require low risk projects since it leaves them with low value). Usdin and Bloom (2012) argue that the first step on this path to recovery is to look at the early warning signs as they appear.

The injection of fresh capital has been used in Ghana to turn the fortunes of distressed companies around. This was particularly used under the Merchant Bank deal. Fortiz Private Equity Fund Ltd. was to inject adequate capital to address the solvency and liquidity challenges facing the bank and implement a turnaround strategy to ensure that the bank continues to operate normally (Bank of Ghana, 2013). The Bank of Ghana also indicates that the strategy includes listing the bank on the GSE within three years. Could it be said then that continuous listing of a company on the stock exchange is sign of financial soundness? The case of Enron and other world cases of bankruptcy prove otherwise.

3.3 Method of Prediction of Financial Distress

Financial distress prediction is a critical accounting and financial research area since 1960s and consequently prediction of corporate financial distress has long been the object of study of corporate finance literature (Ray, 2011). Over the years, several methods have been used by researchers to predict corporate financial distress. Beaver (1966), using statistical analysis in his study on financial ratios as predictors of failure, found financial ratios to be relevant in predicting corporate failure. Beaver's technique accurately classified 78% of the sample companies five years prior to failure (Muller et al., 2009). He identified the ratio of cash flow to total debt as the most important ratio in predicting failure indicating that when financial ratios are used to assess likelihood ratios, the cash-flow to total-debt ratio produces large likelihood ratios, even five years before failure. The defect associated with this study is the use of univariate model in the analysis.

One of the earliest studies on prediction of companies in financial distress was Altman in 1968. The study identified some financial KPIs – working capital, total assets, retained earnings, earnings before interest and tax, market value of equity, book value of total debt and sales) as important in comparing companies in a data set of 33 failed and 33 non-failed companies. Altman's five –variable model correctly identified 95 per cent of the total sample of companies tested for bankruptcy. This percentage rate of success in predicting failure fell to 72 per cent when the data used was obtained two years prior to failure (Glautier and Underdown, 2001). The study came out with a model, the Z-Score, which has received overwhelming endorsement across the globe. It explicitly measures a firm's relative liquidity, longevity, operating profitability, leverage, solvency, and productivity – virtually all aspects of corporate performance, lead to clearer conclusions, avoid judgment bias, reliability (Sulphery, 2013). Rufus (2003) supports this claim concluding that the Z-Score, which combines mutually exclusive ratios into a group, helps overcome the shortcomings of individual financial ratio analysis. The Z-score is a weighted linear combination of five common financial ratios (Barsky et al., 2003).

Al-Khatib and Al-Horani (2012) used Logistic Regression and Discriminant Analysis and made a comparison between the two models to determine which is more appropriate to use as well as which financial ratios are statistically significant in predicting the financial distress of Jordanian companies. A more recent study was conducted in Istanbul by Zeytinoglu and Akarim (2013). They calculated 20 financial ratios to predict the financial failure of firms and developed the most reliable model by analysing these ratios statistically. The study found capital adequacy and net working capital/ total assets ratios are seemed to be significant ratios in the three

periods covered (2009 – 2011).

It must be said that the advent of computer has introduced some modern methods of predicting corporate financial distress with high level of sophistication and accuracy. With the development of computer technology, some new methods based on artificial intelligence technology with distributed computing capabilities that can deal with problems of nonlinear systems are widely introduced into the field of financial distress prediction (Zhuang and Chen, 2014).

In the existing literature, financial ratios or factors are the most frequently used predictors in the models that forecast corporate financial distress using variables for firms from various sectors and/or from firms around the globe (Shah, 2014). The study of Al-Khatib and Al-Horani (2012) found that return on Equity (ROE) and Return on Assets (ROA) are the most important two financial ratios, which help in predicting the financial distress of public companies listed in Amman stock Exchange.

The usefulness of distress prediction models have received overwhelming acknowledgement among scholars. A model of predicting corporate distress would serve to reduce such losses by providing a pre-warning to stakeholders of firms (Shah, 2014). For Ray (2011), distress prediction model will assist a manager to keep track of a company's performance over a number of years and help in identifying important trends.

3.4 Sources of Financial Distress

There is a vast literature comprising of competing theories on micro and macro level causes of banking crisis (Ali, 2007). Financial and non-financial sources could act as major sources of a financial distress, in which the non-financial sources could have a negative impact on financials of the company, and hence, leading to the state of distress (Azadinamin, 2012). Lim (1998) argues that the corporate sector is both affected by a sharp exchange rate depreciation and a major sustained increase in interest rates. He adds that in determining which will have the greater impact on corporate balance sheets depends on a number of factors, including factors such as the depth of the currency depreciation, the length of time in which interest rates are sustained at high levels to support the currency, the amount of maturing external and domestic debt that is rolled over, the additional revenue gain from high export receipts and domestic prices and the extent to which external debt is hedged. Contributing to the effects of interest and currency, Friedman (2000) points out that as a result of interest and currency shocks, distress spread beyond the most problematic sectors and corporations.

A study by Memba and Job (2013) on causes of financial distress in firms funded by Industrial and Commercial Development Corporation in Kenya established that the main causes of financial distress are endogenous variables and that the most significant causes of distress were improper capital decision, inadequacy of capital, access to credit, shortage of skilled manpower, poor accounting records and poor internal Management. They also found that the finance factor was the main cause of financial distress in comparison with management, accounting system, policy changes and liquidity factors. In his study, Adeyemi (2011) identified inadequate capital, lack of transparency and huge non-performing loans are accountable for bank failure in Nigeria. He also points out that factors such as ownership structure, weak/ineffective internal control system, and poor management may also be responsible for failure.

Specific to project finance, Fight (2006, p. 110) argues that in view of their effect on the cash flow available for debt servicing, factors such as market prices, inflation rates, energy costs, tax rates etc can impact debt servicing in a project. This is supported by results of some studies on relationship between the individual variables and debt servicing. Ahmad et al. (2012) find positive and statistically significant relationship between the volume of domestic debt and domestic debt servicing on price level (inflation).

4. Discussion of Model

The Altman model for detection of companies in financial distress is stated as equation (1) below:

$$Z = (1.2X_1) + (1.4X_2) + (3.3X_3) + (0.6X_4) + (1.0X_5) \quad (1)$$

Where $X_1 = \left(\frac{\text{Working Capital}}{\text{Total Assets}} \right)$ (2)

$$X_2 = \left(\frac{\text{Retained Earnings}}{\text{Total Assets}} \right) \quad (3)$$

$$X_3 = \left(\frac{\text{EBIT}}{\text{Total Assets}} \right) \quad (4)$$

$$X_4 = \left(\frac{\text{Equity at Market}}{\text{Total Debt}} \right) \quad (5)$$

$$X_5 = \left(\frac{\text{Net Sales}}{\text{Total Assets}} \right) \quad (6)$$

These indeed are financial ratios computed from financial statements (mainly income statement and statement of financial position) of the entity being studied. Financial ratios are valuable tools in understanding and monitoring a company's financial position and performance (Erdogan, 2013). In general, ratios measuring profitability, liquidity, leverage, and solvency seemed to prevail as the most significant indicators (Altman, 2002) of corporate distress. He adds that the detection of company operating and financial difficulties is a subject which has been particularly amenable to analysis with financial ratios.

In interpreting the model in equation (1), Z-Score greater than 2.99 means the company financially sound, a Z-Score below 1.81 means the company is financially distressed. The gray area between 1.81 and 2.99 was defined as the "zone of ignorance" because of the vulnerability to misclassification (Prevoo, 2007) and may be facing financial deterioration leading to a financial distress (Azadinamin, 2012).

In equations (2), (3), ... and (6), the variables X_1 , X_2 , ... X_5 represent metrics developed out of accounting ratios. The metrics are a combination of various forms of conventional ratios including liquidity, activity, profitability and gearing ratios.

In equation (2), X_1 measures the liquidity of the companies in relation to their total assets. Liquidity ratios are used to examine the ability of a company to meet its short-term financial obligations (Abdullah and Ismail, 2008; Ponikvar et al., 2009) and also used to evaluate creditworthiness (Aysun, 2012). When used in project finance, liquidity ratios provide the tools for evaluating the ability of the project to meet its short-term financial obligations as and when they fall due. On the liquidity metric, Amoa-Gyarteng (2014) indicates that a distressed firm will hold a shrinking portfolio of current assets and therefore lower capital, which translates to a low index.

Metrics X_2 and X_3 in equation (3) measure company profitability. Profitability ratios show firm's overall efficiency and measure both the profit margin that the firm is able to generate as well as the return it provides on the physical facilities and fund it employs (Mary, 2012). Evidently, more profitable firms take less time to meet their liabilities and have to wait longer to collect their receivables (Ponikvar et al., 2009). Retained earnings to total assets ratio indicates the extent to which assets have been paid for by company profits (Ray, 2011). He argues that a low ratio indicates that growth may not be sustainable as it is financed from increasing debt, instead of reinvesting profits.

X_4 in equation (5) represents a measure of leverage. Leverage describes a company's financial structure and measures the long-term risks of a company (Abdullah and Ismail, 2008). The leverage ratio is a widely accepted measure of the additional risk placed on common stockholders as a result of the decision to finance operations with debt (Caplan et al., 2012). George and Hwang (2010) argue that if financial distress is costly and firms make optimal capital structure decisions, low leverage firms will indeed be exposed to greater systematic risk than high leverage firms.

In equation (6), X_5 represents activity ratio which marks the sales and assets. Activity ratios are employed to evaluate the efficiency with which manages and utilises its assets (Pandey, 1999). Thus, if the firm has a low ratio sales to assets, it is implied that some substantial underutilization of assets is occurring, or alternatively that assets are not being efficiently employed (Glautier and Underdown, 2001). Altman (1968) explains that this is one measure of management's capability in dealing with competitive conditions. The computation of Z-Score for the ten selected listed companies are tabulated in tables 1 – 3.

5. Discussion of Results

The results of the study indicate that six (60%) companies show impressive performance and may not be said to be in any state of financial distress. These are Ayrton Drugs Manufacturing Company Ltd., Benso Oil Palm Plantations Ltd., Fan Milk Ltd., Ghana Oil Company Ltd., Produce Buying Company Ltd. and Total Petroleum Ghana Ltd. Of the remaining, two companies – African Champions Industries Ltd. and Aluworks Ltd. – have been observed to be in a state of financial distress while the other two – PZ Cussons Ghana Ltd. and Unilever Ghana Ltd. – appear to be in a state of ignorance and deterioration. Altman's model suggests that the lower the observed Z-score, the greater the risk of bankruptcy (Barsky et al., 2003).

African Champions Industries Ltd. appears to be the worst performer on the application of the Altman model. With the exception of 2007, the company registered negative Z-Scores throughout the period of the study. The worst scores were experienced in the most recent periods of the study (2012 and 2013). In the case of Aluworks Ltd., the worse performance was experienced in 2009 and 2010. Though still in the state of difficulty, the score regained its stability in subsequent years. The management of these companies need to inject sanity into the financial situation of the companies in order to have a turnaround.

The good performance of Produce Buying Company Ltd. on the Z-Score may be accounted for by the attention given by Government to cocoa subsector of the Ghanaian economy. Producer prices have seen massive

increment in the recent years of the study. Clearly, the two oil distribution companies (Ghana Oil Company Ltd. and total Petroleum Ltd.) have shown a great financial performance in the period of study. This portrays the good business environment that companies in the oil distribution industry are enjoying in the country. Ghana Oil Company Ltd. is a best performer among the sample companies. The company has the Government of Ghana as one of its shareholders. This creates some kind of PPP in the oil marketing company and with the sovereign guarantee of the government enabling the company to contract credit with the most favourable terms.

Ayrton Drugs Manufacturing Company Ltd. had the Z-Score for all periods of the study being above 2.99. The company has however been experiencing a drop in the score since 2010, with the lowest observed in 2013. Management of the company has to have a keen eye on the financials of the company before it slips below 2.99. Fan Milk Ltd. has had a remarkable performance over the period of the study; the score has been relatively stable over the period.

PZ Cussons has been in the gray zone throughout the period of the study. It however had its highest score in 2013. Though Unilever Ghana Ltd. had obtained Z-Scores greater than 2.99 in 2007, 2008, 2010 and 2011, the score has dropped sharply to the gray zone between 2011 and 2013. There is a high tendency for the score to slip below 1.81 in 2014. This situation deserves critical attention from management. Benso Oil Palm Plantations Ltd. appears to have had a relatively good score from 2011 to 2013. The index however dropped steadily to 3.12 in 2013.

Apparently, all companies in this study are in active operation and are still listed on the GSE. Could it be said that the Z-Score mistakenly misclassified the two companies as failed companies? Some factors may be responsible for these variations in results. These factors may be environmental in nature. Particular environmental factors in this respect include the accounting standards used in preparing financial statements, and the level of development in the economy. Altman (1968)'s study was conducted on financial statements prepared on the basis of US GAAP while this study was conducted on the basis of IFRS. Variations in standards may account for the difference in results. Again this study was conducted in Ghana, a developing country whereas Altman's study was done in the US, a developed country. However, similar studies were conducted in other developing countries that yielded varying results. Ray (2011)'s on automobile companies found all the companies in the intermediate zone. Ray argues that the lack of harmony in the study of financial distress prediction is partially attributable to the nature of the explanatory variables, as studied for four decades. According to Gharaibeh et al. (2013), the models were developed using data from developed economies. Ray (2011) also adds that the prediction of corporate distress is a common issue in developed economies but has only recently emerged in developing economies. Thus, they may not be suitable to apply in an emerging economy. This study agrees with Appiah (2011)'s study on Aluworks Ltd. which is classified as failed with a Z-Score of 1.98 but could not confirm his results on Fan Milk Ltd. and Unilever Ghana Ltd. also classified as failed with Z-Scores of 2.01 and 1.71 respectively. This study classifies them as financially sound and deteriorating companies respectively. Differences in time periods covered by the studies could, however, create a difference in results between the two studies.

Similarly, this study could not agree in total with the finding of George and Hwang (2010) that low leverage firms have low distress probabilities and greater exposures to systematic risk than high leverage firms. Though the two distress companies have their X_4 metric being less than 1.00 (showing high leverage), it may be observed that a significant number of companies found in this study not to be in distress also experienced high leverage. On this index, it is only Ayrton Drugs Manufacturing Company Ltd. which seems to produce results that agree with their finding.

6. Conclusion and Recommendation

In this paper, I have applied the Altman Z-Score to a data set covering the period from 2007 to 2013 involving ten companies listed on the GSE. I found that six companies were financially sound, two were in financial distress and the remaining two were experiencing financial deterioration. However, the model should be used along with nonfinancial models and proxies that reflect the firm's operating environment (Gharaibeh et al., 2013). Beaver (1966) notes that although ratio analysis may provide useful information, ratios must be used with discretion adding that not all ratios predict equally well and that the ratios do not predict failed and non-failed firms with same degree of success. I therefore caution that in applying the Altman model, care is taken to rationalise the defects of ratios in detecting distress in projects and companies.

Though the results of this study are inconclusive on the bankruptcy state of the companies under the study, management and investors should thread carefully in their corporate appraisals. Companies in distress and gray zones should take steps to reverse the downturn in the performance of the relevant indexes. The analysis indicates some brightness in companies listed on GSE and this could be relied upon by the Government of Ghana and funders under project financing.

7. References

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Tables

Table 1: Results of Z-Score Computations

	2013	2012	2011	2010	2009	2008	2007
African Champions Industries Ltd.							
X ₁	-3.9003	-0.46839	0.098819	-0.18571	-0.16636	-0.13306	0.809274
X ₂	-4.19026	-0.75122	-0.35147	-0.59433	-0.22861	-0.18215	-0.25117
X ₃	0.226027	-0.26807	-0.06924	0.009467	-0.0264	-0.06107	0.730337
X ₄	0.283161	0.231289	0.311852	0.120842	0.141985	0.182783	0.05323
X ₅	0.346271	0.343714	0.378823	0.491634	0.449249	0.353376	0.85454
Z-Score	-9.28467	-2.01592	-0.03604	-0.45954	-0.07236	-0.15316	3.916077
Aluworks Ltd.							
X ₁	-0.01054	0.068738	-0.0666	-0.0666	-0.32812	-0.13776	0.189098
X ₂	-0.18964	-0.31133	-0.3758	-0.30385	-0.16046	-0.02188	0.032934
X ₃	0.01531	-0.00391	-0.01853	-0.30385	-0.05529	-0.01845	-0.02245
X ₄	0.508728	0.473321	0.818663	0.853176	0.112208	0.103153	0.128217
X ₅	0.450495	0.67516	0.919492	0.454016	0.575403	0.805195	1.140596
Z-Score	0.528123	0.592858	0.743498	-0.54209	-0.15812	0.610261	1.416456
Ayrton Drugs Manufacturing Company Ltd.							
X ₁	0.542525	0.64155	0.629944	0.601932	0.680968	0.601589	0.544018
X ₂	0.560478	0.601378	0.555521	0.525187	0.53206	0.416691	0.270864
X ₃	0.043875	0.144786	0.209381	0.189099	0.292551	0.211503	0.21557
X ₄	1.106578	1.857617	1.8446	2.310274	4.547764	3.981317	4.599178
X ₅	1.031621	1.057322	1.031374	0.756821	1.219079	1.139152	1.085404
Z-Score	3.276055	4.261473	4.362755	4.224592	6.475201	5.531177	5.588322
Benso Oil Palm Plantations Ltd.							
X ₁	0.286408	0.421234	0.356297	0.228689	0.207807	0.249292	0.125155
X ₂	0.741029	0.714408	0.631517	0.510132	0.481543	0.472874	0.39755
X ₃	0.133481	0.317006	0.310063	0.111707	0.071886	0.228012	0.041868
X ₄	0.883392	0.733676	1.008573	0.965717	1.075269	1.044932	1.833181
X ₅	0.771666	0.944014	1.104211	0.810836	0.704106	0.940223	0.737046
Z-Score	3.12332	3.935991	4.044242	2.747509	2.510021	3.280795	2.681874

(Source: Own computation of using data from ARG)

Table 2: Results of Z-Score Computations

	2013	2012	2011	2010	2009	2008	2007
Fan Milk Ltd.							
X ₁	0.188954	0.139209	0.257881	0.355617	0.257131	0.217116	0.198085
X ₂	0.656128	0.53526	0.630373	0.615958	0.568963	0.468988	0.400472
X ₃	0.299051	0.380837	0.301982	0.379714	0.398638	0.289123	0.262581
X ₄	0.402966	0.286763	0.482882	0.614817	0.374251	0.524109	0.730549
X ₅	1.372574	1.524676	1.315343	1.517378	1.613472	1.675117	1.732315
Z-Score	3.746545	3.869912	3.793593	4.428405	4.258635	3.86081	3.835524
Ghana Oil Company Ltd.							
X ₁	-0.05917	0.028683	0.042729	0.038217	0.032243	0.145946	0.209137
X ₂	0.072171	0.167946	0.177063	0.154995	0.122654	0.089298	0.076821
X ₃	0.084598	0.086641	0.103889	0.102164	0.108564	0.081369	0.065832
X ₄	0.195616	0.101091	0.145104	0.168481	0.16703	0.15934	0.199278
X ₅	4.877735	5.250056	5.526664	4.967838	4.227638	4.399374	3.767202
Z-Score	5.304316	5.866169	6.255724	5.668923	4.896524	5.063647	4.46253
Produce Buying Company Ltd.							
X ₁	-0.087	0.032056	0.088581	0.006981	-0.05167	0.003394	0.058321
X ₂	0.06394	0.113018	0.11219	0.043672	0.061941	0.024501	5.452368
X ₃	0.12576	0.210525	0.262443	0.222793	0.226005	0.164567	0.019925
X ₄	0.05221	0.062408	0.066089	0.103159	0.057646	0.081745	0.15821
X ₅	3.436867	4.020185	4.745157	3.744301	4.529878	3.638436	5.452368
Z-Score	3.868317	4.949055	5.914235	4.610934	5.334997	4.268927	13.31635
PZ Cussons Ghana Ltd.							
X ₁	0.396107	0.313289	0.371598	0.365484	0.293655	0.291598	0.298693
X ₂	0.460354	0.412698	0.449039	0.468497	0.411648	0.399546	0.416649
X ₃	0.141495	0.015495	0.133003	0.120762	0.054416	0.124293	0.14668
X ₄	0.064061	0.069765	0.04505	0.069653	0.069653	0.066705	0.102528
X ₅	1.313207	1.321847	1.162224	1.307512	1.161791	1.115065	1.002064
Z-Score	2.938402	2.126716	2.702737	2.842298	2.311851	2.474537	2.489367

(Source: Own computation of using data from ARG)

Table 3: Results of Z-Score Computations

	2013	2012	2011	2010	2009	2008	2007
Total Petroleum Ghana Ltd.							
X ₁	-0.04275	-0.00615	-0.01289	0.000778	0.040484	0.140657	0.189188
X ₂	0.154038	0.127401	0.101596	0.094245	0.0743	0.438757	0.537725
X ₃	0.138876	0.144175	0.138348	0.094245	0.131122	0.293167	0.184541
X ₄	0.217138	0.249557	0.325751	0.325751	0.596001	0.537129	0.585054
X ₅	3.942743	4.659331	4.313913	4.224612	3.771259	1.580908	1.91717
Z-Score	4.695666	5.455828	5.09268	4.863947	4.714165	3.653684	3.857028
Unilever Ghana Ltd.							
X ₁	0.153412	0.113719	0.130416	0.045257	0.035096	0.140657	0.189188
X ₂	0.162104	0.197011	0.37469	0.391567	0.40038	0.438757	0.537725
X ₃	0.110866	0.151244	0.271201	0.22814	0.019036	0.203379	0.160861
X ₄	0.007524	0.009841	0.015374	0.019959	0.023015	0.021623	0.034548
X ₅	1.683333	1.835498	1.888979	1.766705	1.895279	1.580908	1.91717
Z-Score	2.464748	2.752786	3.474232	3.134046	2.574554	3.048081	3.448581

(Source: Own computation of using data from ARG)

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